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EVALUATION OF BEEF CATTLE INDUSTRY BREEDING PROGRAMS

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A critical evaluation of existing beef cattle breeding programs should include such criteria as: definition of desired genetic changes in performance, breeding value estimation procedures used and accuracy of selection criteria, intensity of selection applied, use of additive differences between breeds and of non-additive variation, maintenance of genetic variability, realised genetic trends and return on investment. Each major production-marketing environment should be treated and correct account taken of the industry structure. Such a study would undoubtedly highlight any inadequacies in the essential information. To extend the study to adequately cover all major beef industries would be an enormous task. However, Koch et al. (1986) make a useful contribution by concentrating on the US industry and limiting their evaluation to a subset of the above criteria. Parnell et al. (1986) and McClintock (1986) go beyond evaluation of existing programs with their original treatment of two important areas in beef cattle breeding, viz. across-herd genetic evaluation and uses of simulation, respectively.

Reliable multi-herd genetic evaluation is becoming increasingly feasible and popular, following developments in field and analytical procedures and in computing. Parnell et al. note the important influence of population structure (herd size distribution, number of segments in the industry and whether the nesting of segments is complete) on preferred multi-herd strategies. They also emphasize our limited understanding of the impact of data structure on the realised correlations between true and estimated breeding value. What is adequate linkage in these unbalanced data sets and to what extent can field design requirements be relaxed when an 'animal model' is used for the multi-herd genetic evaluation analysis? Further, how does the analytical laboratory treat the very occasional outlier in multi-herd evaluation? Deleting these during editing can raise objections and possibly a few of the outliers are genuine and valuable.

With the rapid development of the computing and communications technologies, simulation is becoming an increasingly important tool for use in breeding research and teaching and as a decision-making aid in practise. McClintock identifies six use categories, but then emphasizes the economic applications. Taking a broad perspective of economic decision-making, he describes and relates the three areas appropriate to breeding, viz. the evaluation of investment opportunities (his Investment Marketing Package), objectives, and return on investment. This seems a useful partitioning.

After surveying the status of breeding in the US industry, Koch et al. return to a primary need, to define breeding objectives. Probably most beef cattle industries are in the same predicament. This arises from the tortuous and often interrupted path market signals must travel from the consumer to the seed-stock producer; and from our poor understanding of precisely how to define the breeding objective. McClintock contributes to this understanding with his view on how to treat the (linear) profit function in the more complex and common beef industry situation where the one breeding program involves several products and markets.

Koch et al. refer to the importance of documenting differences between breeds and between herds within breeds, to aid in the development of breeding plans. McClintock extends this by calling for an increased effort to collate biological and economic knowledge of performance of breeds and crosses, for use by on- and off-farm decision-makers.

Parnell et al. (1986), McClintock (1986) and Koch et al. (1986) recognise mixed model technology as an important development in the application and evaluation of breeding programs. Combined with the rapid developments in computing, it will enable us to simultaneously use most information in the data set; including that for all relatives and for correlated traits measured on or off the farm. This should substantially increase the accuracy of selection for the lowly heritable traits. However, it requires efficient estimates of all (co)variances, including knowing the importance of genotype by environment interactions for the selection criterion. Multi-herd genetic evaluation systems which are capable of utilising all data will also provide further opportunities for evaluating central testing, where the data structure is adequate.

Producer acceptance of the mixed model technology can develop from the increased comfort of knowing that relatives and mating and selection biases are taken into account. However, it seems that most interest is created by models which partition direct and maternal effects and by the reporting of trends resulting from sire and dam selection. At least for some sectors of the US and Australian industries the genetic trends show that the phenotypic evaluation procedures used in the past have had a substantial impact. We can expect greater change from the new genetic evaluation procedures, particularly where the market signals are clear and the breeding objective defined. However, in diverse industries we should also anticipate some worrying genotype by environment interactions for cow survival and lifetime profitability where genetic evaluations are undertaken for the breed as a whole.

Another significant step in performance recording and genetic evaluation is likely to result from automating animal identification and some measurement operations. This will modify some of the traits currently recorded and add others. It should certainly improve our ability to detect genetic differences between animals for the growth complex. However, it will further increase the complexity of our analytical and computing procedures (McClintock, 1986).

As Koch et al. suggest, the challenges are to maximise the cost-effectiveness of these new (and powerful) technologies, and the ability to merchandise genetic superiority. Here, the contribution by breed associations should increase, even though the number of registrations may currently be decreasing.

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